Oyster Restoration Pre-construction Site Assessment of the Manokin River Sanctuary

Prepared by Oyster Recovery Partnership

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Introduction

As part of the 2014 Chesapeake Bay Watershed Agreement, Maryland committed to restoring oyster populations in five tributaries in Maryland's portion of the Chesapeake Bay by 2025. Progress to complete the 5 tributary restoration strategy is monitored by the Maryland Interagency Workgroup (hereafter Workgroup). The Manokin River is the fifth tributary selected for restoration under the 5 tributary strategy. This tributary is located on the lower eastern portion of Maryland's Chesapeake Bay and has been closed to wild commercial harvest since 2010. The mouth of the river empties into Tangier Sound and this area has historically exhibited strong oyster recruitment.

The Workgroup used data from the Maryland Department of Natural Resources (DNR) patent tong surveys conducted in 2012, 2015, 2017 and 2018 to determine the status of the oyster populations on habitat within the Manokin River sanctuary. National Oceanic and Atmospheric Administration (NOAA) completed additional GIS analysis, and this information was used to determine initial restoration construction areas: premet (defined as already meeting density and biomass targets), seed-only, and substrate and seed (Table 1). Premet reefs were estimated to be 20 acres, seed-only restoration reefs were estimated to be 305 acres, and substrate and seed restoration reefs were estimated to be 438 acres. A systematic patent tong survey was conducted to groundtruth and verify the accuracy of the restoration types determined for areas selected for restoration. This survey is ongoing and is expected to take several years to assess between 401 to 763 acres.

Table 1. The general guidelines for determining the most appropriate type of restoration.

	Premet Criteria	**Seed-Only Criteria**	**Substrate and Seed Restoration Criteria**
Depth	4-20 ft	4-20 ft	7-20 ft
Bottom Type	on shell dominant bottom, sand, sand & shell, muddy sand, muddy sand & shell, sandy mud, and sandy mud & shell (not on shell dominant bottom) also on hard subsurface sediments identified by sub-bottom profiling sonar	on shell dominant bottom	sand, sand & shell, muddy sand, muddy sand & shell, sandy mud, and sandy mud & shell (not on shell dominant bottom). also on hard subsurface sediments identified by sub-bottom profiling sonar

Oyster Density	> 50 per m^2 (also oyster biomass > 50 g per m^2)	<50 per m^2	< 5 per m^2
Lease Proximity	Not within 150 ft of leases	Not within 150 ft of leases	Not within 150 ft of leases
Navigation Aid Proximity	Not within 250 ft of navigation aids	Not within 250 ft of navigation aids	Not within 250 ft. of navigation aids
Dock Proximity	Not within 50 ft of private docks	Not within 50 ft of private docks	Not within 250 ft. of private docks
SAV Proximity	No intersection with SAV beds	No intersection with SAV beds	No intersection with SAV beds

Methods

The Spring 2021 round of Manokin River groundtruthing took place in July and August 2021. A total of 12 sites were sampled by the Oyster Recovery Partnership, in collaboration with local waterman, Bobby Walters (Table 2).

Table 2. Sites chosen for the Spring 2021 groundtruthing survey in Manokin River Sanctuary.

Restoration Type	Site ID	Area (acres)	Number of PT replicates	Report Reef ID
Substrate and seed	SS_08	5.71	39	MN_52
Substrate and seed	SS_20	18.22	124	MN_64
Substrate and seed	SS_21	12.38	82	MN_65
Substrate and seed	SS_22	11.85	80	MN_66
Substrate and seed	SS_23	18.02	124	MN_67
Substrate and seed	SS_24	10.10	69	MN_68
Substrate and seed	SS_25	7.83	58	MN_69
Substrate and seed	SS_26	4.32	30	MN_30
Substrate and seed	SS_27	2.29	16	MN_71
Substrate and seed	SS_37	18.27	125	MN_81

Substrate and seed	SS_42	1.23	9	MN_86
Substrate and seed	SS_44	1.74	12	MN_88

Two analytical approaches were used to assess the accuracy of the restoration types and determine the appropriate treatment type of areas slated for restoration. The first approach determines whether a site needs restoration based on the abundance and biomass of oysters currently on the site, while the second approach used an index of habitat quality to determine whether a site is suitable for restoration and the type of restoration required. An index of habitat quality was developed to determine whether oyster habitat was suitable for seed-only restoration, substrate and seed restoration, or not suitable for either (e.g. an area consisting of all mud that cannot support restoration). Six benthic habitat components observed from samples were used to develop the index:

1. Exposed Shell
2. Primary Substrate and Secondary Substrate
3. Surface Sediment
4. Number of Live Oysters
5. Surface Shell, calculated as (Total shell volume x percent gray shell) – total shell volume
6. Oyster density and biomass data

The first five benthic components are given a binary score expressed as a 1 or 0, with a result of 1 suitable for restoration construction and 0 being unsuitable (Table 3).

Table 3. Five benthic habitat components used to develop the index of habitat quality and the criteria used to establish a binary score for each component.

Benthic Component	**Suitable for Oysters**
Exposed Shell	Shell 50% exposed or greater
Bottom Type	Oyster, loose shell, or shell hash
Surface Sediment	Less than 5 cm
Number of Live Oysters	Greater than 5 oysters per square meter
Surface Shell Volume	Greater than 10 liters per square meter

A final habitat suitability score for each grid cell is calculated as the sum of each benthic component score at the individual grid cell using the equation:

$$Habitat\ Suitability\ Score = S1 + S2 + S3 + S4 + S5$$

Where S1 = Exposed Shell Score, S2 = Bottom Type Score, S3 = Surface Sediment Score, S4 = Number of Live Oysters Score, and S5 = Surface Shell Volume Score. The result of habitat suitability scores will determine whether a sampling grid cell is suitable for restoration construction based on a ranking between zero and five. Ranks of one or two are suitable for substrate and seed restoration, ranks of three require additional review, and ranks of four and five are suitable for seed-only restoration. A rank of zero is considered unsuitable for restoration.

The oyster density and biomass data assessment for each grid are over the entire reef and if both density and biomass are greater than 50 oysters per m^2 and 50 grams per m^2, the reef is considered premet.

Results

A total of 768 patent tong grabs were collected over 7 days during this phase of groundtruthing. The density of oysters was 0.67 individuals/m^2 but nearly 89% of the samples contained no live oysters (Table 4). Less than 5% of cells had a composite score of 4 or 5, meaning the majority of area surveyed in this round will require substrate addition.

Table 4. Summary results from the Spring 2021 groundtruthing survey.

Site ID	Dominant Substrate Type	Total Live Oysters Observed	Average Total Volume (L/m^2)	SD Volume	Depth Range (ft)
SS_08	Shell Hash	613	4.66	3.68	10.8–14.2
SS_20	Sand	0	0	0	7–12
SS_21	Sand	0	0	0	7–12
SS_22	Sand	115	0.41	1.72	9.5–16
SS_23	Sand	2	0.04	0.25	7.5–13.1
SS_24	Sand	0	0	0	7.5–12
SS_25	Sandy Mud	0	0	0	8–11.1
SS_26	Sand	40	1.00	1.67	9.4–11.7
SS_27	Sand	0	0	0	7.8–10.6
SS_37	Sand	185	1.44	2.59	8.5–12.4
SS_42	Sand	10	1.41	2.46	9.1–11

SS_44	Sand	0	0	0	8.4–9.3

The composite score for each cell was displayed in ArcGIS to allow visual review of the results for each site. As was expected during this phase of groundtruthing, most sites sampled revealed sandy bottom with little to no shell present (Figures 1-4). With the exception of one cell, SS_08 was mainly scores of 3 or 4, suggesting that is might be suitable for Seed Only restoration. The next step in determining treatment types for these polygons is a discussion at the Workgroup level.

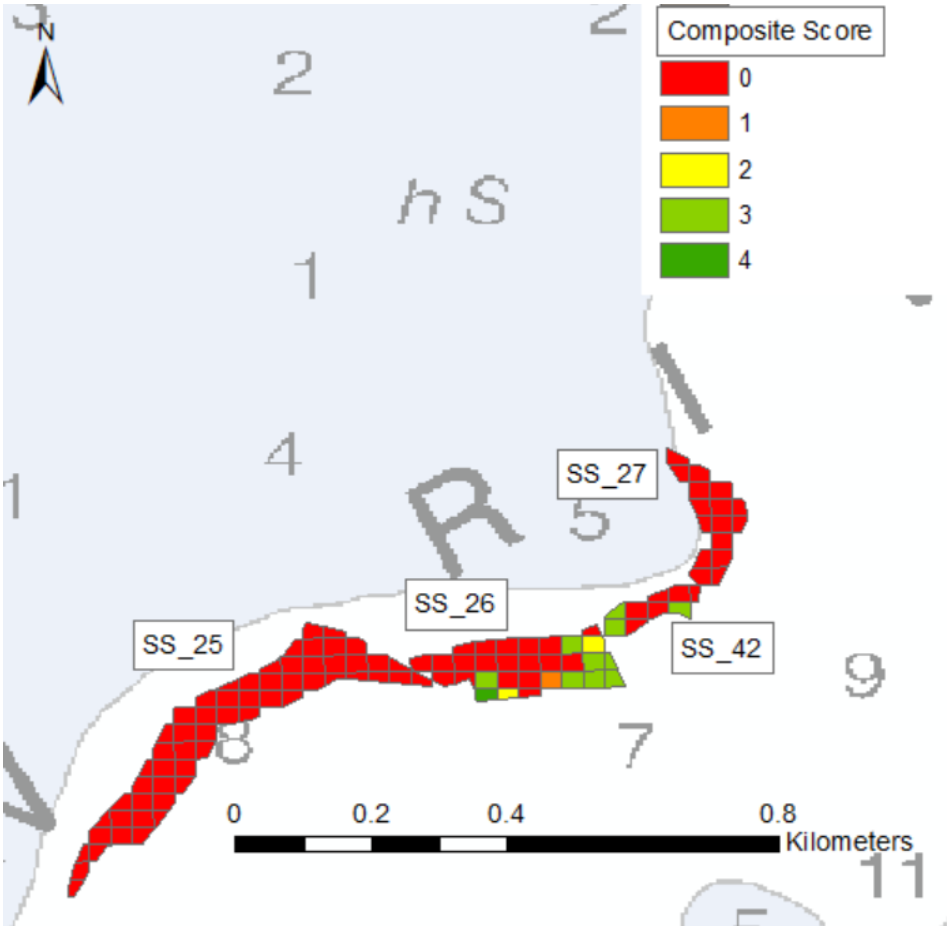

Figure 1. Results for four sites sampled during the spring 2021 phase of groundtruthing. Aside from SS_26, these sites would likely need substrate added before deploying spat on shell. Discussion at the Workgroup level is needed to finalize treatment plans.

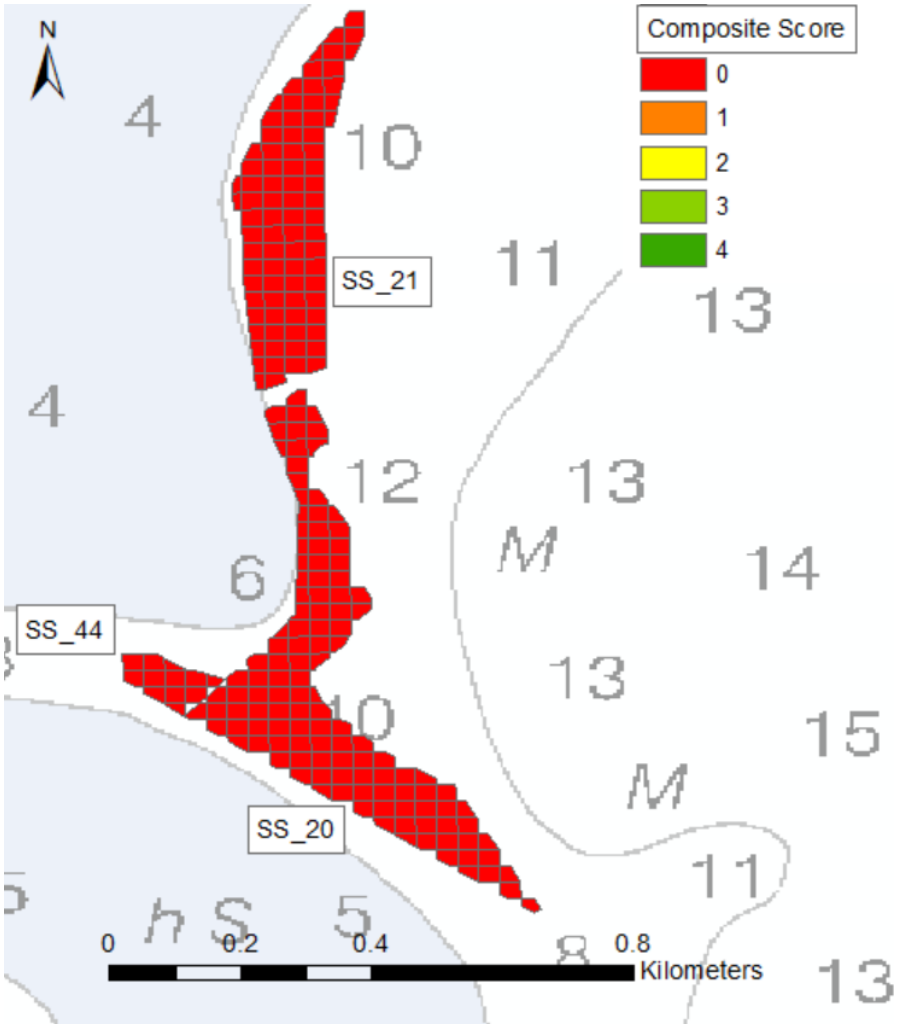

Figure 2. SS_21, SS_44, and SS_20 were characterized by mostly sandy substrate. No live oysters were found on these sites, suggesting that Substrate and Seed is the most appropriate treatment type.

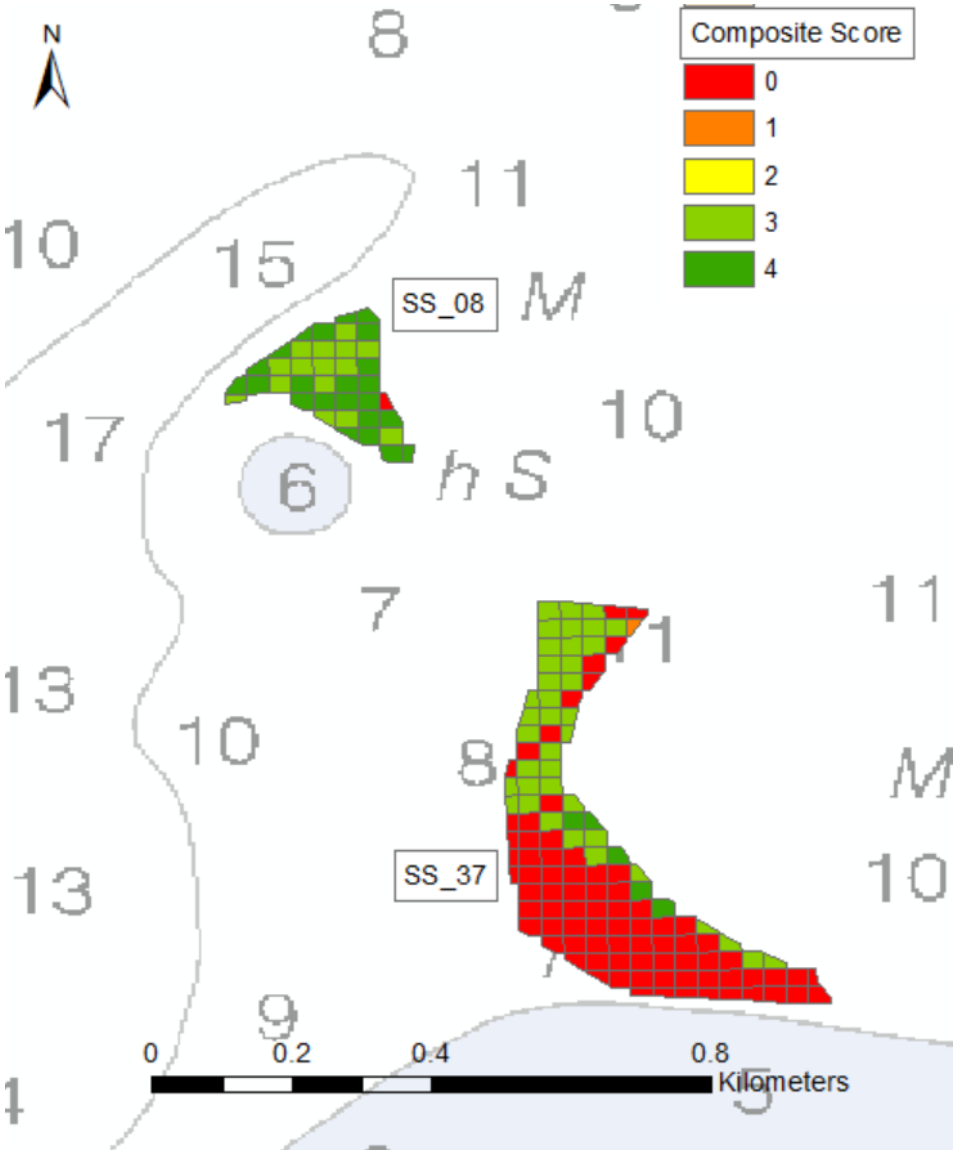

Figure 3. The cells sampled in SS_08 scored mostly 3 and 4, suggesting that further review is required but this site could potentially be changed to Seed Only. SS_37 seemed to have both cells suitable for Seed Only treatment as well as some poorly scoring cells. Changing the boundaries of this site or dividing it into two areas might be appropriate.

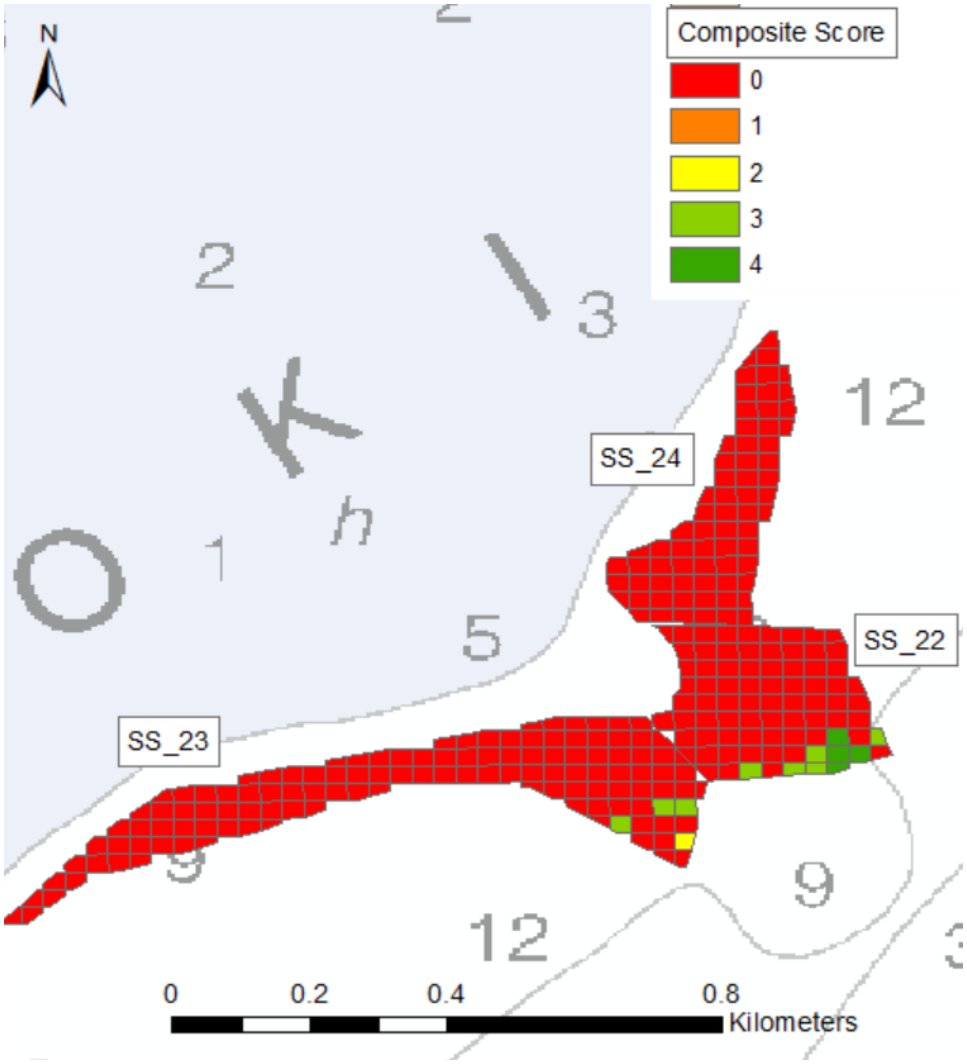

Figure 4. SS_23 and SS_24 should remain Substrate and Seed sites. SS_22 had several high scoring cells along the southern edge, so perhaps the site boundary should be altered.